



Design and implementation of polishing robot control system

Taizhi Lv

School of Information Technology, Jiangsu Maritime Institute, Jiangsu Nanjing
211170, China

lvtaizhi@163.com

Abstract: In order to improve the intelligent level of grinding equipment and realize the intelligent upgrading of enterprise production, an intelligent grinding control system is designed and implemented in this paper. The system has the advantages of low cost, high precision and high speed. It is mainly used for grinding spare parts of electrical equipment. The main functions of the system include autonomous polishing, autonomous process and user interaction. The self-control in the polishing process realizes the servo motor and pneumatic components to drive and simulate the human hand movement and force control function, and the intelligent polishing is adaptive according to the shape of the polished object. The independent process realizes automatic loading and unloading and automatic dust removal, and realizes accurate control of on-site process parameters. User interaction is realized through touch screen, computer, mobile phone and other ways.

Keywords: Polishing robot, robot arm, control system, user interaction, automatic loading and unloading.

1. Introduction

With the continuous advancement of strategies such as industry 4.0 and made in China 2025, intelligent manufacturing has been widely used [1-2]. With the continuous development of new generation information technologies such as industrial Internet, big data and blockchain, the goal of process control in the manufacturing industry has been raised to the intelligent level. Mold processing is an important part of manufacturing technology, and polishing is an important link. Traditional polishing adopts manual method, which not only has high cost, but also has unstable quality. How to intelligentize and automate the polishing process is not only a challenge for the tooling processing enterprises, but also the only way for the enterprises. In recent years, with the rapid development of technology, intelligent robots have been widely used in various neighborhoods [3].

Manipulator is a kind of intelligent robot. It has the characteristics of high precision, multi-input and multi output, high nonlinearity and strong coupling [4-5]. It has been widely used in manufacturing industry and has become the development trend of processing and manufacturing industry. The robot arm is similar to the human arm and has strong degrees of freedom, which can be applied to the polishing of molds. By analyzing the process of manual polishing, the grinding process is extracted, and the same action as human polishing is achieved through program control, so as to replace manual to realize automatic polishing. Based on this, this paper designs and implements the polishing robot control system to automate the polishing process, reduce the human burden and improve the production efficiency and quality.

2. Functional design

According to the production needs of the enterprise, the intelligent grinding control system shall have the following functions.

- (1) Control the operation state of the grinding machine arm, including the start and stop, forward rotation and reverse rotation of each servo motor of the grinding machine arm, the control of each cylinder and the control of electrical proportional valve, so as to make each rotating joint of the robot work in coordination.
- (2) The polishing speed of the polishing machine arm can be adjusted within a certain range on the premise of ensuring the stability of its motion speed. There are three options: low speed, medium speed and high speed.
- (3) The intelligent grinding control system shall have power supply safety control function, and the power supply status can be displayed on the panel.
- (4) The intelligent polishing control system shall have the display function, provide various control operation interfaces for users through the touch screen, and display the running state of the machine. At the same time, it can also make the user more convenient and simple to understand the state of the control system and the corresponding setting and working mode of the polishing robot.
- (5) The intelligent grinding control system shall have the functions of detecting abnormalities and audible and visual alarm. At the same time, a photoelectric limit switch shall be added before the mechanical limit. In order to prevent the mechanical structure of the machine from being damaged in case of accidental failure of the control system, or the rotation speed of the motor exceeds the maximum speed, when an abnormal signal is detected, make corresponding shutdown treatment immediately and give audible and visual alarm signals to prevent accidents.
- (6) The intelligent grinding control system shall have emergency stop function. In order to press the button fastest during operation and operation, the emergency stop

button is required to be installed on the control panel of the robot. When the emergency stop key is pressed in test mode, the emergency stop function will immediately disconnect the driver, while the brake is powered off and the brake is maintained. In the automatic mode, the emergency stop button can immediately disconnect the power supply of the driver, so as to stop the machine immediately. Once the polishing robot is stopped, the driver will be disconnected, so as to protect the equipment and personal safety.

3. Intelligent polishing control process

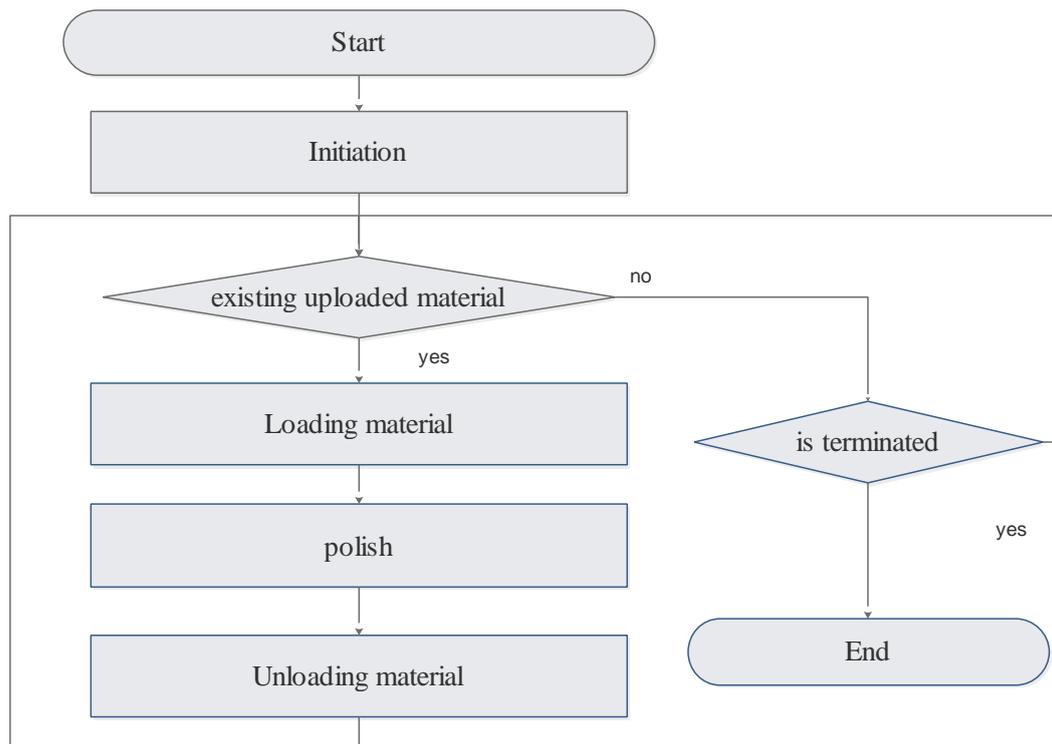


Fig. 1 Automatic polishing flow chart

At present, the research of control system mostly focuses on the integer order, and the conventional PID (Proportional Integral Differential) controller has been widely used in industrial process. With the deepening of scholars' research on fractional order, the theoretical research of fractional order control system began to receive attention. Fractional order PID controller can achieve better performance than conventional PID controller [6]. In this paper, fractional PID is applied to the intelligent polishing control process. According to the characteristics and types of polishing process, according to the enterprise production process and based on the Internet of things, an intelligent polishing management mode driven by real-time data perception and data processing is constructed.

Step 1: System initialization

System initialization is mainly the initialization of control module parameters and

system startup parameters.

Step 2: Loading material

The loading material process of polishing robot is mainly completed by motor transmission. Its main process includes setting timer, starting transmission motor, detecting whether the workpiece is in place, clamping workpiece, alarm display, closing transmission motor, etc. The specific work flow is as follows: first set the timer time, then start the transmission motor to let the conveyor belt start transmitting the workpiece, and then detect whether the workpiece has reached the specified position through the photoelectric switch. If it has not reached the specified position, carry out audible and visual alarm and close the transmission motor. If the workpiece has reached the specified position, suspend the transmission motor, and start the clamping cylinder to clamp the workpiece, so far the feeding is finished.

Step 3: Automatic polishing

The core of the polishing function is the advanced integrated pressure control technology. In the polishing process, the intelligent control system is implemented on different nodes of the workpiece through digital programming to accurately control the wear compensation of abrasive and ensure the consistent product quality.

Step 4: Unload material

In the blanking process, the blanking of the polishing robot is transmitted by the motor to check whether the blanking is completed.

4. Conclusion

The intelligence of robot is the synthesis of various technical applications, and its level is closely related to the overall scientific and technological level of the country. The traditional grinding method is mainly manual, which not only does great harm to human body, but also its quality cannot be guaranteed. The design and implementation of polishing robot has practical significance. It can realize adaptive intelligent polishing and integrate automatic loading and unloading and dust removal devices, realize the integration of management and control, and improve the automation level of industrial control.

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